

CLAIMS

What is claimed is:

1. A thermal management system, comprising:

a heat generating component that comprises a first area and a second area, wherein the first component area generates more heat than the second component area; and

an evaporator thermally coupled to the heat generation component to transfer the heat from the component to a working fluid, wherein the evaporator comprises a plurality of micro-channels to provide fluid paths from the component, wherein the micro-channels have a first channel width and a second channel width, wherein the micro-channels having a first channel width are disposed adjacent to the first component area and the micro-channels having a second channel width are disposed adjacent to the second component area, wherein the first channel width is different from the second channel width.

2. The thermal management system of claim 1, further comprising:

a heat exchanger coupled to the evaporator to remove heat from the working fluid; and

a pump coupled to the heat exchanger to transfer the working fluid to the evaporator.

3. The thermal management system of claim 1, further comprising:

a thermal interface material coupled to the component and the evaporator,

wherein the thermal interface material reduces a thermal interface resistance between the component and the evaporator.

4. The thermal management system of claim 1, wherein the working fluid comprises water, super critical carbon dioxide, Freon, ammonia, methanol, acetone, ethanol, or heptane.
5. The thermal management system of claim 1, wherein the component is a central processing unit, wherein the first component area is a processor and the second component area is a cache.
6. The thermal management system of claim 1, wherein the first channel width is greater than the second channel width.
7. The thermal management system of claim 1, wherein the working fluid is thermally coupled to the second component area before being thermally coupled to the first component area.
8. The thermal management system of claim 1, wherein the evaporator is divided into a top portion and a bottom portion, wherein the working fluid is warmed in the top portion before reaching the bottom portion.
9. The thermal management system of claim 1, wherein apertures provide nucleation sites in the plurality of micro-channels.
10. The thermal management system of claim 1, wherein indentations provide nucleation sites in the plurality of micro-channels.
11. The thermal management system of claim 1, wherein a horizontal sintered copper powder layer provide nucleation sites in the plurality of micro-channels.

12. The thermal management system of claim 1, wherein vertical sintered copper powder walls provide nucleation sites in the plurality of micro-channels.

13. A thermal management system, comprising:

means for providing heat transfer in micro-channels of an evaporator that is thermally coupled to component having a first temperature area and a second temperature area; and

means for increasing nucleation site density in the micro-channels.

14. The thermal management system of claim 13, further comprising:

means for transferring a working fluid from the first temperature area to the second temperature area.

15. The thermal management system of claim 13, comprising:

means for gradually warming a working fluid.

16. An evaporator, comprising:

micro-channels to provide a heat flow path from a component having a first area and a second area, wherein the first area has a higher power than the second area;

an inlet plenum coupled to the micro-channels to input a working fluid to a fluid passageway of the micro-channels; and

a sintered copper powder layer coupled to the micro-channels to provide nucleation sites for the working fluid.

17. The evaporator of claim 16, further comprising:

a divider to divide the evaporator into a top portion and a bottom portion,

wherein the working fluid enters from the top portion, wherein the working fluid is warmed in the top portion before being transferred to the bottom portion.

18. The evaporator of claim 17, wherein the divider comprises copper or silicon.

19. The evaporator of claim 16, wherein the micro-channels comprise channels having a first width and channels having a second width, wherein the first width is greater than the second width.

20. The evaporator of claim 19, wherein the channels having a first width provide a flow path from the first area of the component, wherein the channels having a second width provide a flow path from the second area of the component.

21. An evaporator, comprising:

micro-channels having a first channel width and a second channel width, wherein the micro-channels having the first channel width are thermally coupled to a core area of a central processing unit (CPU), wherein the micro-channels having the second channel width are thermally coupled to a cache area of the CPU.

22. The evaporator of claim 21, wherein a working fluid is warmed over the cache area before being thermally coupled to the core area.

23. The evaporator of claim 21, wherein the micro-channels comprise a fluid passageway for transporting the working fluid and a vapor formation chamber, wherein vapors are transmitted from the vapor formation chamber to the fluid passageway through an aperture.

24. The evaporator of claim 21, wherein the micro-channels comprise

indentations to provide nucleation sites.

25. The evaporator of claim 21, wherein the micro-channels are coupled to a sintered copper powder layer that provides nucleation sites, wherein vapors are transmitted from the nucleation sites to the fluid passageway.

26. A method, comprising:

transferring heat from a heat generating component to an evaporator, wherein the heat generating component has a first temperature area that is not equal to second temperature area, wherein heat is transferred from the first temperature area through a first plurality of flow channels, wherein heat is transferred from the second temperature area through a second plurality of flow channels, wherein the first plurality of flow channels are wider than the second plurality of flow channels; and

generating vapors through a plurality of nucleation sites.

27. The method of claim 26, further comprising:

warming up a working fluid over the second temperature area before the working fluid is thermally coupled to the first temperature area.

28. The method of claim 26, further comprising:

warming up the working fluid in a top portion of the evaporator.

29. The method of claim 28, further comprising:

transferring the working fluid to the bottom portion of the evaporator.

30. A silicon die, comprising:

a processor core;

a cache coupled to the processor core;

a first plurality of channels positioned over the processor core to provide a flow path for the heat generated by the processor core; and

a second plurality of channels positioned over the processor cache to provide a flow path for the heat generated by the cache, wherein the first plurality of channels have different widths than the second plurality of channels.

31. The silicon die of claim 30, wherein the widths of the first plurality of channels are greater than the widths of the second plurality of channels.

32. A computer system, comprising:

a processor;

a cache coupled to the processor; and

a cold plate having micro-channels to provide a flow path for heat generated by the processor and the cache to a working fluid, wherein the micro-channels that provide flow paths from the processor are greater in width than the micro-channels that provide flow paths from the cache.

33. The computer system of claim 32, further comprising:

a pump coupled to the cold plate to transfer the working fluid to a heat exchanger;

a fan coupled to the heat exchanger to cool the working fluid in the heat exchanger; and

an expansion valve coupled to the heat exchanger to reduce the pressure of the working fluid before the working fluid is returned to the cold plate.

34. The computer system of claim 32, wherein the cold plate comprises a top portion and a bottom portion, wherein the working fluid enters the top portion and is heated in the top portion before exiting through the bottom portion.

35. The computer system of claim 32, wherein the micro-channels of the cold plate have apertures to provide nucleation sites for vapors to form.